CENTRAL INTELLIGENCE AGENCY
WASHINGTON, D.C. 20505

6330

27 November 1973

MEMORANDUM FOR: William E. Hale
LNG Competitive Price Task Group
Council on International Economic Policy
Old Executive Office Building

SUBJECT : LNG Project Costs and Prices

The attached table of LNG costs and prices is being forwarded as requested during our telephone conversation on 21 November 1973. Generally the data reveal a wide variation in estimates due to the subjective views of different estimators as to costs, volumes, inflation, interest rates, economies of scale, and transport distances. If you have further questions we will try to answer them. You will note that the order of projects differs somewhat with those on the list forwarded earlier, but this change was necessary since the status of several projects has advanced while others are only tentative.

Office of Economic Research

Attachment:
As stated

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A Comparison of Existing, Planned and Proposed LNG Project Costs and Prices - Revised November 1973

LNG Project		Gas Volume (Million CFD)	CIF Price ($/1000 CF)	FOB Price ($/1000 CF)	LNG Plant + Port (Million $)	Gathering and Pipeline (Million $)	Tankers (Million $) Size	Shipping Distance (Nautical Miles)	Project Start-UP (Year)	Comments
Operational										
Algeria Arzew	[illegible], Canvey	100	$.76	?	$87 with Port	$70 (24 inch 300 mile)	(2) $35 (27,500m³)	1,900	1964	
	France, Le Havre	50	.62	?			(1) 15	1,500	1965	
Alaska Kenai	Japan, Tokyo	140	.52	?	100	?	(2) 52 (71,500m³)	3,400	1969	
Libya Marsa El Brega	Italy, LaSpezia	240	.39	?	200 with Port	?	(3) 125 (39,750m³)	800	1971	Many delays due to technical political problems which caus cost overruns to exceed plan
	Spain, Barcelona	110	.44	.34			(1) ? (39,750m³)	950	1971	
Algeria Skikda	France, Fos	350	.39	.30	190	?	(2) 60 (39,750m³)	400	1972	2 years behind schedule
	US Distrigas, Boston	50	.68 - .84	?	?	?	(2) 105 est. ?	3,600	1972	
Brunei	Japan #1	550	.49	?	220 + 55 Port	?	(4) 190 (73,140m³)	2,500	1972	
	Japan #2	225	.80 - .90 est	?	170	?	(2) 135 (73,140m³)	2,500	1974	
Firm Plans or Under Construction Using 1975/1976 Costs and Prices										
Algeria Arzew	- US-El Paso #1 Cove Point & Savannah	1,000	.77 - .83	.31	318 + 87 Port	181 (40 inch 300 mile)	(9) 742 (125,000m³)	3,470	1976	
	- US-El Paso #2	1,000	1.03 - 1.09 est	.42	?	?	(9) 1,000 est	3,470	1980 est.	
	- US-EASCO	600	1.03 - 1.09 est	.46	285	?	(4) 270+ (125,000m³)	3,400	1976	
-7 Country W. European Consortium		1,500	?	.41	?	?	?	1,000-2,000	1978	
	- W. Germany	1,200	?	?	?	?	?	2,000	1979	
	- Spain	150	.39	?	120	?	(1) 20	300	1974	
		450	?	?	340 est	?	(2) ?	300	1976 est.	
Sarawak	- Japan	700 - 1,000	.95	?	300 + 20 Port	?	(4) 240+ (125,000m³)	3,700	1977	
N. Sumatra	- US West Coast	550	.95 - 1.20 est	.63	400	?	(5) ?	7,000	1978	
	- Japan	550	.90 est	?	?	?	? ?	4,000	1978	
Trinidad	- ? Mid-east	500	?	?	260 with Port	?	(3) 140 (73,750m³)	1,900	1976	
Proposed or Tentative Using 1979/1980 Costs and Prices										
USSR	- US-"North Star"	2,000	1.25	.60	1,508 with Port	2,246[1] (48 inch 1500 mile)	(20) 2,631 (125,000m³)	4,033	1978-1979	[1] Includes $55 million wort of pipelaying equipment
USSR	- US & [illegible]apan-Yakutsk	1,000 (Los Angeles)	1.00 - 1.10	.50 - .60	512 + 48 Port	2,000[2] (56 inch 2000 mile)	(16) 1,600 (125,000m³)	4,500	1979-1981	[2] Includes $265 million wor of pipelaying equipment
		1,000 (Tokyo)	.90	?				500		
Kalimantan	- US or [illegible]apan	300	?	?	?	?	?	7,500 to US	1978	
Ecuador	- US	400	?	?	?	?	?	3,200	?	
Alaska	- US	200 - 400	?	?	280	?	(1) 135 (125,000m³)	2,200	1977	
NW Australia	- US or Japan	600	?	?	?	?	?	8,000-2,500	1977	
Nigeria	- US	1,200	?	?	?	?	?	5,100	?	
Venezuela	- US	400	?	?	?	?	?	1,900	?	

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7 December 1973

MEMORANDUM FOR: Mark D. Coler,
Special Assistant to the Director
Bureau of East-West Trade
US Department of Commerce

SUBJECT : Contribution to CIEP LNG Economic Review

Attached is CIA's contribution to outline section II.D., LNG Real Cost Analysis. We have attempted to follow the structure of CIEP's outline as exactly as possible, with the exception of the comments on implications for financing needs which seemed to fit more appropriately as placed in paragraph 4 of our contribution than at the later point indicated by the original outline.

Office of Economic Research

Attachment:
As stated

(7 Dec 73)

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7 December 1973

MEMORANDUM FOR: Richard D. Erb
Council on International
Economic Policy
Old Executive Office Building

SUBJECT : Contribution to CIEP LNG Economic Review

Attached for your information is a copy of CIA's contribution to outline section II.D., LNG Real Cost Analysis. We have forwarded it to Mark D. Coler, Special Assistant to the Director, Bureau of East-West Trade, Department of Commerce, for integration with the Department of Commerce contribution to that section.

Office of Economic Research

Attachment:
As stated

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Contribution to CIEP LNG Economic Review

Part II. D. LNG Real Cost Analysis

Capital Costs

Divergent Consortium Estimates

1. Comparison of the estimates of capital cost for facilities in the USSR made by the consortium concerned with the North Star Project (Tenneco, Texas Eastern Transmission Corporation, and Brown and Root) with those made by the consortium concerned with the Yakutsk Project (El Paso Natural Gas, Occidental Petroleum Corporation, and Bechtel Corporation) raises questions concerning the probable actual level of such costs. Both projects involve construction of gathering systems and long-distance pipelines that will traverse permafrost zones of the USSR. Both projects involve construction of a liquefaction plant and related storage and port facilities capable of supporting deliveries of 2 billion cubic feet of gas per day. It would be reasonable to assume that the cost of the two projects would be roughly similar. Inasmuch as the length of the planned 56-inch diameter pipeline from Yakutsk to the vicinity of Nakhodka is some 2,000 miles, one-third greater than the approximately 1,500 mile length of the planned 48-inch diameter North Star pipeline, it would be reasonable to expect that the capital cost of the Yakutsk Project would be greater than that of North Star. As the following table shows, however, consortium estimates do not indicate that this would be the case.

Estimated Dollar Investment In Facilities in the USSR

(In Millions of US Dollars)

	North Star Project Consortium Estimate		Yakutsk Project Consortium Estimate		
	Base Cost in 1972 $ a/	Cost in 1980 $ b/	Base Cost in 1973 $ a/	Cost in 1979 $ c/	in 1980 $ d/
Pipeline and Gathering System	1,448.6 e/	2,246.4 f/	1,430.1 g/	2,017 h/	2,138
LNG Plant and Terminal Facilities	838.7	1,507.7	394.1 i/	562 j/	596
Total	2,287.3	3,754.1	1,824.2	2,579	2,734

a/ Including freight charges.

b/ Includes additional allowance for interest during construction, contingencies, and escalation of prices due to inflation at 6% per year.

c/ Basic estimate adjusted by the consortium and Stanford Research Institute. Overall rate of escalation at 6% per year, based on a 3% compound rate of currency inflation, allowance for contingencies, interest during construction, 3.5% annual escalation in pipeline and related costs, and 4% annual escalation in LNG plant costs.

d/ Projection to 1980 based on continuation of 6% annual increase in cost. Done for purposes of comparison with North Star. Not by consortium.

e/ Includes pipelaying equipment valued at at least $57 million. On the basis of data for 1980, probably includes about $79 million for the gathering system.

f/ Includes $125.7 million for the field gathering system. The size of this figure -- when compared with the figure for the more extensive Yakutsk field gathering system -- suggests that it must also include well costs.

g/ Of which, $36 million is for the gathering system and $263 million for pipelaying equipment.

h/ Of which, $51 million is for the gathering system and $373 million represents escalated pipelaying equipment costs.

i/ Of which, $34.9 million is for port facilities.

j/ Of which, $50 million is for port facilities.

In addition to the above dollar costs, each consortium anticipates that ruble costs equivalent to about $1 billion would be incurred by the USSR for construction of facilities on its territory.

Pipeline Costs

2. After deducting the cost of the gathering systems and pipelaying equipment, the base year cost of the North Star pipeline is about $875,000 per mile (in 1972 dollars) compared to $565,000 per mile for the Yakutsk-Nakhodka line (in 1973 dollars). Escalated to 1980 prices, these figures become approximately $1.4 million per mile for North Star and $850,000 per mile for Yakutsk. The base costs of the Yakutsk consortium do not appear unreasonably low in the light of other information. The highest cost reported by the Northern Natural Gas Company for 60-inch diameter pipelines laid in 1970 was $490,000 per mile. Soviet publications, dated 1968-70, indicate cost norms of 220,000 to 230,000 rubles per kilometer for 1,220-millimeter (48-inch diameter gas pipelines (including compressor stations) over difficult terrain. Converted at the exchange rate of 1 ruble = $1.34 effective since 20 November 1973, these costs become approximately $475,000 to $495,000 per mile. Even at an exchange rate of 1 ruble = $2.00, they would be only about $710,000 to $740,000 per mile. These norms, which may be equated to 1969 prices, will, under the Soviet system, remain effective until administratively changed. The direction and

degree of such change by 1980 is difficult to predict with any precision. However, the index of Soviet construction costs in 1969 was about 22% higher than it was in 1955. Price changes in the USSR occur abruptly at infrequent intervals as corrective measures are deemed necessary, rather than more gradually as in the West. Nevertheless, the above change in the Soviet construction cost index works out to an average annual increase of 1.4% per year. If this factor is used to inflate the $710,000 to $740,000 per mile range to 1980 prices, the result is a range of some $825,000 to $860,000 per mile, figures that are surprisingly close to the El Paso consortium's estimate of cost for the Yakutsk pipeline. If the Yakutsk pipeline costs per mile were applied to the North Star project, the cost of the North Star pipeline and field gathering system would be about $1.4 billion, rather than the estimated $2.2 billion.

LNG Plant Costs

3. As the above table indicates, the Tenneco consortium's estimate of necessary capital investment in the liquefaction plant and related facilities is about 2½ times that of the El Paso group's. Again there is evidence to support the belief that the Tenneco estimate may have been exceedingly cautious. Liquefaction plant, storage, and port facilities in Algeria that will have roughly half the capacity contemplated for each of the Soviet projects are expected to cost about $400 million. Doubling this figure would result in a cost of $800 million, and some economy of

scale should be expected. Consequently, inflating the cost of these Algerian facilities, scheduled to be in operation in 1976, to 1980 dollars should still result in a cost of less than $1 billion, rather than the $1.5 billion estimated by Tenneco. Moreover, as the cost of constructing facilities in the Soviet Union would be incurred prior to 1980, pricing the facilities in 1980 dollars results in what should be regarded as a maximum, rather than a probable, estimate of cost.

Implication for Financing Needs

4. The above suggests that the dollar costs of facilities in the Soviet Union for the North Star project might be in the range of $2 billion to $2.5 billion, rather than the $3.75 billion estimated by the Tenneco consortium. The relationship between such capital costs for North Star and the estimated cost of the Yakutsk project seems more reasonable than that indicated by the original consortium estimates, given the more extensive gathering system[1/] and longer pipeline required for the Yakutsk project. A one-third reduction in the cost of North Star facilities on Soviet soil would reduce the need for Export-Import Bank and US commercial institution financing accordingly, from nearly

1/ The poorer quality of Yakutsk reserves will probably necessitate a larger number of wells, and hence a more extensive gathering system, than will be required in the Urengoy field for North Star.

$3.4 billion to some $2.3 billion. Under existing guidelines, the USSR would be expected to contribute a down payment of at least 10%, about $250 million.

Operating Costs

Divergent Consortium Estimates

5. Both groups of US firms have indicated that they anticipate an f.o.b. Soviet port price of about 60¢ per 1,000 cu. ft. They divide the costs differently, however, as is indicated by the following tabulation.

	U.S. ¢ per 1,000 cu. ft.	
	North Star	Yakutsk
Pipeline and Gathering System	32	37
LNG Plant and Terminal Facilities	28	24
Total	60	61

Disregarding the gathering systems, the cost of transporting gas via the 1,500 mile North Star pipeline works out to about 2.13¢ per 1,000 cu. ft. per 100 miles. This cost is about 15 percent higher than the comparable cost of 1.85¢ per 1,000 cu. ft. per 100 miles via the 2,000 mile pipeline contemplated for the Yakutsk project. The North Star allowance of 28¢ per 1,000 cu. ft. for the LNG plant and related terminal facilities is nearly 17 percent higher than the comparable estimate for Yakutsk.

Soviet Gas Production Costs

6. No Soviet estimates of the local cost of gas from the Urengoy field in Western Siberia, or from the Yakutsk area in Eastern Siberia are available, probably because these fields have not yet begun to produce gas in quantity, and production costs are not firmly estimated. However, the cost of production at the Medvezh'ye field, about 125 miles west of Urengoy and with similar conditions, has been reported as 0.61 ruble per 1,000 cubic meters. Soviet technicians, however, expect this cost to decline to 0.28 ruble per 1,000 cu. m. as cluster drilling techniques are applied more extensively. To this production cost should be added one ruble per 1,000 cu. m. that Soviet accounting allows for exploration costs.

Soviet Pipelining Costs

7. A Soviet source gives the cost of transporting gas by 48-inch diameter pipeline as 1.252 rubles per 1,000 cu. m. per 1,000 kilometers under optimum conditions and 2.3 rubles under difficult conditions. The corresponding figures for 56-inch diameter pipelines were given as 0.998 and 1.9 rubles. The conditions of the proposed projects surely qualify as difficult. Thus, the indicated cost for the 2,400 kilometer trip by 48-inch line from Urengoy to Murmansk would be 5.52 rubles per 1,000 cu. m. The cost of transporting gas by 56-inch line for 3,200 kilometers from Yakutsk to Nakhodka would be 6.08 rubles per 1,000 cu. m. Of

these costs, 46% is amortization and 54% is operating cost -- wages, materials, electric power, and gas.

Ruble Cost of Gas Delivered to LNG Plant

8. Adding 54% of the transport cost to production and exploration costs of 1.28 rubles, yields an operating cost of 4.26 rubles per 1,000 cu. m. or 0.121 ruble per 1,000 cu. ft. for gas delivered to Murmansk, and 4.56 rubles per 1,000 cu. m. or 0.129 ruble per 1,000 cu. ft. for gas delivered to Nakhodka. (This cost is exclusive of capital charges and replacement equipment costs which are included in the estimates of dollar costs for the two projects.) Because of the heavy weights assigned to relatively cheap Soviet inputs, fuel and labor, a conversion rate of 1 ruble = $1.00 seems more appropriate for converting these ruble operating costs into dollars than would the higher official exchange rate. The operating costs to the Soviets of gas delivered to the liquefaction plant would thus be equivalent to about 12¢ per 1,000 cu. ft. for the North Star project, and about 13¢ per 1,000 cu. ft. for the Yakutsk project.

Liquefaction Costs

9. Unfortunately no Soviet data are available for estimating the probable cost of liquefaction in the USSR. TEAL, a French company that has pioneered in the LNG field, in 1972 quoted production costs of 23.5¢ per 1,000 cu. ft. for a plant with a capacity of 4.5 billion cubic meters per year (about 450 million cu. ft. per day). Of this amount, 2¢ were for internal gas consumption,

7¢ for operating costs, and 14.5¢, or 62% of the total, for capital costs. (The estimate assumed: a 6% interest loan, 15-year linear amortization, 15% net yield on capital, and 50% tax on gross yield.) TEAL indicated that increasing the capacity of the plant by about 56% to 7 billion cubic meters per year (700 million cu. ft. per day) would reduce unit production cost by 10.6%, from 23.5¢ to 21¢ per 1,000 cu. ft. Doubling the capacity to 9 billion cubic meters per year (900 million cu. ft. per day) would reduce the cost to 20¢ per 1,000 cu. ft. It is evident that a considerable economy of scale is achieved as the capacity of the plant increases, and the plants proposed for use in the Soviet Union are about 4.5 times the size of the one used as the basis for the French cost estimate.2/ The French company also quotes a further 15% reduction in total production cost if the duration of the LNG contract is extended from 15 years to 20 years, and the proposed Soviet contracts are for 25 years. Extrapolating from these data, a total production cost of 15¢ per 1,000 cu. ft. seems reasonable for a plant with the capacity being discussed for the

2/ Some further idea of the economies of scale involved is afforded by an article in the September 1972 issue of Gas, written by Morton Litwak, Manager, Economic Evaluation Department, Air Products and Chemicals, Inc., a subsidiary of Brown and Root. Mr. Litwak indicated that doubling the capacity of a liquefaction plant capable of delivering 500 million cu. ft. per day to a capacity of 1 billion cu. ft. per day would reduce the cost from 33¢ per 1,000 cu. ft. to 29¢ per 1,000 cu. ft. Also, in studying the proposed Yakutsk project in 1972, Bechtel Corporation, one of the El Paso consortium, estimated production costs at 27¢ per 1,000 cu. ft. for a plant with a capacity of 1 billion cu. ft. per day and at 24¢ per 1,000 cu. ft. for a plant with a capacity of 2 billion cu. ft. per day.

Soviet projects. Of this amount, about 2¢ per 1,000 cu. ft. would be for what TEAL classified as "operating cots," apparently including maintenance, replacement of equipment, and labor; something less than 1¢ per 1,000 cu. ft. would be for internal consumption of gas; and the rest would be capital cost. If it is assumed that the costs cited by TEAL in 1972 were current costs, and that the 15¢ cost extrapolation from them hence would be in 1972 dollars, inflation at 6% per year would result in a 1980 cost of about 24¢, the figure used by the El Paso group.

Total Soviet Costs

10. It seems probable that the chief elements of Soviet operating costs -- labor, materials for maintenance (as distinct from equipment maintenance and replacement which is included in the dollar operation and maintenance charges), and gas consumed by the LNG plant -- will remain relatively constant. On the basis of the above data, these ruble costs have been estimated as being equivalent to about 15¢ per 1,000 cu. ft., or to some $3.1 billion over the life of the North Star project. (The 15¢ consists of 12¢ per 1,000 cu. ft. for exploration, gas production, and pipeline operation, and of 3¢ per 1,000 cu. ft. for labor, maintenance, and gas consumption at the LNG plant.) Coupled with the estimated $1 billion equivalent in ruble construction costs, the ruble cost of the North Star project would come to somewhat over $4 billion.

Quantities of Gas Available to U.S.

11. There appears to be no question that the reserves of the Urengoy field in Western Siberia are more than adequate to support the contemplated delivery of 2 billion cubic feet of gas per day to the US east coast under the North Star project. Soviet literature claims 60 trillion to 85 trillion cu. ft. of explored reserves and potential reserves of 140 trillion to 210 trillion cu. ft. This would make it the largest known gas deposit in the world, capable of supporting at least 3 or 4 projects the size of North Star. The adequacy of reserves in the Yakutsk region of Eastern Siberia to support proposed deliveries to 1 billion cu. ft. of gas per day for 20 years to the US west coast, and another billion cu. ft. per day to Japan, is not so certain. The present exlpored reserves in the Yakutsk area would not support such deliveries, but Soviet technicians hope to discover more than 35 trillion cu. ft. by 1975. Although some participation in the financing of exploration might be feasible in the short run, any agreement concerning long-term delivery of gas from the Yakutsk area to the US should await the results of that exploration and depend on dedication to the project of adequate explored reserves from specified deposits.

12. To deliver 2 billion cu. ft. of gas per day to the US east coast under the North Star project, nearly 2.2 billion cu. ft. per day would have to be loaded on board the tankers to allow for boiloff and consumption en route. Approximately 796

billion cu. ft. would be loaded in each year of full-scale delivery, and over the life of the project the quantity would total nearly 21 billion cu. ft.

Implications of Costs for Prices and Profits

13. At a price of 60¢ per 1,000 cu. ft., Soviet gross earnings over the life to the North Star project would total more than $12.5 billion and, if investment in the field gathering system, pipeline, liquefaction plant, and related terminal facilities is $3.75 billion as estimated by the Tenneco consortium, net dollar earnings would be nearly $6.2 billion. If, on the other hand, capital investment in these facilities should be on the order of $2.5 billion, as is suggested by the El Paso consortium's estimate of costs for the Yakutsk project, net dollar earnings at the price of 60¢ per 1,000 cu. ft. would total about $7.8 billion over the life of the contract. Taking ruble investment and ruble operating costs into account under the assumption of $2.5 billion in dollar investment would reduce net earnings to $4 billion.3/ Taking ruble costs into account under the original assumptions of the project would reduce net earnings to about $2.1 billion. Thus, lower investment costs than anticipated by the consortium would, at the prices and quantities being considered, make the North Star project much more profitable for the USSR.

3/ This figure assumes that ruble investment would be reduced in proportion to the reduction in dollar investment, i.e., by one-third.

14. Leaving ruble costs out of consideration, if investment in the facilities in the USSR should be on the order of $2.5 billion, rather than $3.75 billion, an f.o.b. price of 53¢ per 1,000 cu. ft. would, over the life of the contract, yield the Soviet Union gross earnings of over $11 billion and net dollar earnings of about $6.3 billion, slightly more than the net dollar earnings it would realize from the proposed f.o.b. price of 60¢ per 1,000 cu. ft. with the anticipated higher capital investment and consequent higher capital charges. The DCF rate on the stream of net revenues derived from the lower investment would be about 25%, compared to a rate of about 16% under the original assumptions of the project. At the price of 53¢ per 1,000 cu. ft., net revenues after taking into account ruble costs would be about $2.5 billion, a little more than under the original proposal with investment of $3.75 billion. If further engineering studies indicate that substantially lower capital investment is probable, future negotiations might reasonably seek to establish an f.o.b. price that would be a few cents lower than is now contemplated. In any case, it would seem that the contract should provide for some adjustment of the prices, depending on the actual level of investment.

Implication of Lower LNG Tanker Cost for Transport Price

15. As in the case of the pipeline and liquefaction plant, the Tenneco consortium appears to have been excessively cautious in estimating the cost of LNG tankers with a capacity of 125,000

cu. meters as high as $130 million each. Three tankers of this capacity now under construction in France, for use in El Paso's Algerian LNG trade, are to cost $63 million each. Not all of this difference in cost can be attributed to the fact that the North Star tankers are to be built in US yards. Three 125,000-cubic meter capacity tankers under construction in the United States for Eascogas are to cost about $90 million each. (Because of the subsidy paid by the US Maritime Administration to reduce the difference between costs in US and foreign shipyards, the selling price of these tankers would be only $68 million.) El Paso has ordered six 125,000-cubic meter capacity tankers for construction in US yards, three of which are to cost about $99 million each ($74 million not including the subsidy). The average cost of tankers for El Paso's delivery of Algerian LNG (scheduled to start only two years before North Star deliveries) is about $88 million, or if only the six tankers to be built in US yards are considered, about $100 million. General Dynamics Corporation recently announced that its Quincy, Massachusetts shipbuilding division has received a $380 million order to build four 125,000-cu. m. LNG tankers for Burmah Oil Ltd. to use in transporting gas from Indonesia to Japan. These tankers, the first of which is to be delivered in December 1976, and the last in July 1978, will cost an average of $95 million each.

16. If the North Star tankers should cost $100 million each, rather than $130 million each, the reduction in capital charges

would be such that the same total net revenue could be realized over the life of the contract at the transport price of 59¢ per 1,000 cu. ft. as would be realized at a price of 65¢ with the higher capital investment. If operating expenses prove lower than originally anticipated, an even lower price would be possible without reduction in net earning.

Implications of Cost for the Landed Price

17. If, as suggested by the above, capital investment for facilities in the Soviet Union should prove to be in the range of $2 billion to $2.5 billion, rather than $3.75 billion, and if the cost of LNG Tankers should be $100 million, rather than $130 million, the same net revenues could be realized at a landed price in the range of $1.10 to $1.15 per 1,000 cu. ft. as would be earned from a landed price of $1.25 per 1,000 cu. ft. under the original cost assumptions of the North Star project.

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23 November 1973

MEMORANDUM FOR: Albert Jankowitz, Director,
Policy Division
Bureau of East-West Trade
Department of Commerce

SUBJECT : Contributions to CIEP LNG Economic Review

Attached are CIA's contributions to outline sections II. F.2., Security of Supply, and II.F.3., Bargaining Positions for Future Prices.

Office of Economic Research

Attachment:
As stated

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23 November 1973

MEMORANDUM FOR: Richard D. Erb
Council on International
Economic Policy
Old Executive Office Building

SUBJECT : Contribution to CIEP LNG Economic Review

Attached for your information is a copy of CIA's contribution to outline sections II.F.2., Security of Supply, and II.F.3., Bargaining Positions for Future Prices. We have forwarded the contribution to Albert Jankowitz, Director, Policy Division, Bureau of East-West Trade, Department of Commerce, for integration with Department of State and Department of Commerce contributions to those sections.

Office of Economic Research

Attachment:
As stated

II.F.2 Security of Supply

1. Reserves of gas in the Urengoy field of Western Siberia are more than adequate to support delivery of 2 billion cubic feet (cu.ft.) per day to the US east coast as contemplated under the North Star project. Soviet literature claims 60 trillion to 85 trillion cu. ft. (1.7-2.4 trillion cubic meters) of explored reserves and potential reserves of 140 trillion to 210 trillion cu. ft. This would make it the largest known gas deposit in the world, capable of supporting at least 3 or 4 projects the size of North Star. The adequacy of reserves in the Yakutsk region of Eastern Siberia to support proposed deliveries of 1 billion cu. ft. of gas per day for 20 years to both Japan and the US west coast is not so certain. The present explored reserves in the Yakutsk area would not support such deliveries, but Soviet technicians hope to discover more than 35 trillion cu. ft. by 1975. Further exploration will be required, and the USSR has requested credits from US and Japanese firms to cover the cost of seismic surveys and exploratory drilling in the Yakutsk fields. Any eventual contractual agreement will depend on dedication to the project of sufficient explored reserves from specified deposits.

2. Even where adequacy of reserves is no problem, security of supply will depend on the solving of difficult technical problems that will be encountered in constructing and operating, under Arctic conditions, liquefaction plants of the size contemplated. Similarly, development of the gathering systems and long-distance pipelines in the permafrost zone of the Soviet Union will involve technology never before applied on such a scale. In previous attempts at permafrost pipelining, Soviet technicians experienced difficulty with high winds that caused pipe to vibrate and fall off of raised pilings; ground thaw that caused pipe laid on or in the ground to heave, buckle, and break; freezing and rupture of control valves; and failure of welds at pipe connections. US technicians, however, feel confident that they have solved the problems of pipelining in permafrost through research and construction of experimental lines on the Alaska North Slope and in the Mackenzie River Valley of Canada.

3. Deliveries of 3 billion cu. ft. of Soviet LNG per day would be equal to a little less than 3% of estimated US demand for natural gas in 1985, and to less than 1% of the total energy consumption forecast for the US in that year. The 2 billion cu. ft. per day of West Siberian gas proposed for delivery under the North Star project would be equal to

less than 10% of estimated demand for gas on the US east coast in 1985. Unless Soviet deliveries of LNG were concentrated in some one area of the east coast for which alternative sources of gas were not available any shortfalls in Soviet deliveries should not cause insurmountable problems. The supply of 1 billion cu. ft. per day of Soviet LNG to the US west coast market in 1985 probably would have even less significance in that market than would the North Star gas on the east coast, unless the west coast deliveries were concentrated in regions where gas use is relatively small.

4. Technical problems could lead to interruption of supply. This has proved to be the case with deliveries to the US from Algeria where Sonatrach, the State-owned company involved, has had more experience in operating an LNG plant than have Soviet technicians, and where geographic and climatic conditions are not as difficult as in the Soviet Union. It seems unlikely that the USSR would deliberately delay or shut off shipments, or attempt to use the leverage of its position as a supplier unless it had a compelling reason for doing so. In the past, the USSR has placed considerable importance on establishing a reputation as a responsible and reliable trading partner. Nevertheless, during the recent Arab-Israeli conflict, it did reduce its deliveries of oil to Italy to enable it to compensate for a reduction in

deliveries of Iraqi oil to Eastern Europe. In this instance the USSR apparently gave priority to the needs of Eastern Europe, probably primarily to those of Bulgaria which depends on Iraqi oil (obtained for the most part on Soviet account) for about half of its supply.

5. Soviet need for foreign exchange with which to buy technology and equipment, and the opportunity to earn sizable amounts of hard currency by exporting LNG to the US, seems powerful incentive for the USSR to be a reliable supplier. The USSR chronically incurs a deficit in its trade with hard currency countries. Over the past decade, this deficit has averaged more than $300 million per year. It jumped from about $300 million in 1971 to $1.4 billion in 1972, primarily because of large-scale imports of grain, and in 1973 it may reach $2 billion. Contracts now being discussed with Western companies could result in further large-scale imports of equipment during the mid-to late-1970s, and concomitant large-scale deficits in the Soviet balance of payments will persist until export earnings can ease the situation.

6. For a number of years, the export of oil has been the USSR's largest single source of hard currency. In 1972 Soviet earnings from such exports, primarily to Western Europe, totaled about $580 million. However, forecasts of Soviet oil production and demand indicate a possible reduction

in net exports during the latter half of the decade. The reserves of older producing regions are being depleted more rapidly than anticipated, well yields are decreasing, and the share of water in total liquid produced is increasing. Future increases in oil output will have to come from deeper deposits in the older regions, from new fields in Central Asia and Western Siberia (where geological and climatic conditions render much of Soviet oilfield exploration and production equipment inadequate), or from offshore deposits. To develop these reserves satisfactorily, the USSR needs western drill pipe, bits, special drilling tools, drilling fluids, casing, blowout preventers, special cements, refrigerants, insulation, large-diameter linepipe, tractors, pipelaying equipment, valves, pumps, and compressors. To locate and develop additional reserves, the USSR needs seismic exploration equipment, well logging equipment, computer playback centers for evaluating seismic and well logging data, portable drilling rigs, and offshore drilling equipment. Soviet offshore experience, thus far has been very limited, conducted primarily without use of modern offshore equipment. This situation undoubtedly has contributed to Soviet desire to develop other sources of foreign exchange, such as the export of natural gas.

7. The Soviet natural gas industry also needs western technology and equipment, especially US technology and equipment for permafrost pipelining (and perhaps for permafrost drilling). Export of LNG to the US affords opportunity for earning large amounts of foreign exchange that can be used to finance imports of technology and equipment, not only to use in exploiting oil and gas reserves, but also for general industrial development as well. Soviet desire not to jeopardize such earnings probably constitutes the best guarantee of security of supply.

II.F.3. Bargaining Positions for Future Prices

1. The bargaining position of the US companies probably has been weakened by recent publicity about an "energy shortage." The USSR, believing that the United States urgently needs to import the LNG, may seek greater advantage in the form of more technical assistance, higher prices, or a pipeline route and port facility located more suitable for serving domestic as well as export purposes. Moreover, there have been indications that some Soviet officials oppose sale of the LNG to the US on the grounds that the USSR should conserve its natural resources for its own future use. The President's announced policy of attempting to achieve independence and self-sufficiency in energy supply by 1980 could help to dispel the idea that a prolonged energy shortage will put the US in the market for LNG at any price. Programs for development of domestic oil production, gasification of coal, and possible utilization of oil shale deposits will support the argument that imported LNG must be priced competitively. The potential for foreign exchange earnings is probably the best argument for Soviet flexibility.

2. At the f.o.b. price of 60¢ per 1,000 cu. ft., the USSR would realize gross earnings of some $475 million in each year of full-scale delivery under the North Star project. Over the life of the contract

these gross earnings would total about $12.5 billion. If investment and financing as now contemplated by the consortium, recovery of the USSR's own dollar investment in facilities on its soil, amortization of indebtedness for those facilities, and meeting charges for repair and replacement of imported equipment would reduce this amount to net dollar earnings of about $6 billion. Rather than lose the prospect of dollar earnings even approaching this magnitude, the USSR might make some concession on price.

S-5669

CENTRAL INTELLIGENCE AGENCY
WASHINGTON, D.C. 20505

15 November 1973

MEMORANDUM FOR: William E. Hale and Andrew Safir, Council on International Economic Policy

SUBJECT : LNG Competitive Price Study

The attached is in response to your memorandum of 25 October 1973. None of the estimated prices of domestic or foreign petroleum originated in this office; they were obtained from US technical journals and/or company reports. In view of the present upheaval in the world oil market, price estimates for energy in the future are tenuous at best.

Office of Economic Research

Price Estimates for Energy
Resources Competitive to Soviet LNG

1. In general, most of the price estimates for domestic and foreign gas given in the table attached to your memorandum of 25 October agree with information available to us. Although the price of $1.25-$1.40 shown for Item No. 1, Soviet LNG (North Star), appears high when related to probable production and transport costs, it does not seem unreasonable when compared with the possible price of energy from alternative sources in the 1980s. Rapidly rising prices for oil indicate, however, that the estimates for item 12 and 13 should be changed.

Item 12-SNG Naphtha: Price probably would be $1.75 to $2.00/million (MM) BTU in 1973 and could rise to as much as $2.50/MMBTU in 1974.

During the past year the price of naphtha, which accounts for 80%-85% of the processing costs for SNG, has increased from 8-9 cents per gallon to 15-20 cents per gallon. It is anticipated that the spot prices of naphtha in Europe in 1974 will increase at least another 50%. Because the US will be dependent on imported naphtha for much of its supply for SNG production, a further escalation of the price for SNG is certain. Capital costs of plants, although a less significant factor, have

also risen. The current outlook for the proposed output of SNG from naphtha in the US appears dim. If all of the 30 or more announced plants were built (by 1985) they would require 30 million tons of naphtha annually, almost the total amount now used in the world for the manufacture of petrochemicals. With the current and probable long run shortage of feedstock, both domestic and foreign, a new plant would have little chance of lining up supplies of naphtha, propane, or crude oil.

Item 13-SNG Oil: Price estimate probably should approximate the $1.75-$2.00/MMBTU for SNG from naphtha in 1973 because of the sharply escalating prices for oil. (However, no revised price estimates have been reported to date.)

2. Deletion of Item No. 15, LNG Landed (Region 2), is recommended as the source of the LNG is not specified.

3. Available literature suggests that, under different assumptions, price estimates other than those shown in the table could be derived for the following items:

Item 23-Persian Gulf Methanol: Price estimate - $0.91/MMBTU in 1973 prices.

This price, based on an article in Oil and Gas Journal of 11 June 1973, included an assumed raw gas value of 10 cents/MCF, a 15% fixed cost of capital

investment, and the cost of transporting methanol to the US east coast in 200,000 DWT tankers.

Item 24-Persian Gulf LNG: Price estimate - $1.25/MMBTU in 1973 prices.

The same cost and investment assumptions as above are assumed, with transport of LNG to the US east coast in 125,000 cubic meter LNG carriers.

4. A list of estimated product cost for delivered LNG for projects under consideration throughout the world, as prepared by a US firm in April 1972, is attached.

5. Other energy sources which should be included in the list of alternatives are LNG from North Sea gas, shale oil, shale gas, and oil from tar sands. However, this office has no estimates of price for such fuels. The Department of Interior (Bureau of Mines) is the logical agency to estimate the price of energy from oil, shale and tar sands. A recent North Sea gas contract indicates a possible US FOB price of 60 cents/MMBTU by 1976-77. Transport costs to the US east coast would be considerably lower than from Murmansk, USSR.

6. There are indications that the USSR may be considering an increase in the price of natural gas for export. A recent Soviet trade delegation to the US reportedly proposed a 50% increase in the price of natural gas to be delivered to the US and Japan from East Siberia. US petroleum company

officials believe that SNG at $2.00/MMBTU is expected to be competitive with alternative energy sources in the mid to late 1970s because of the sharply rising cost of these alternatives.

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LNG PROJECTS

		Ocean Haul Nautical Miles	Product Cost ¢/MMBTU To Plant	LNG Plant	LNG Tanker	CIF Port
OPERATIONAL						
(1)	Arzew to Canvey Island					78R
	to Le Havre					66R
(2)	El Brega to La Spezia					43R
	to Barcelona					47R
(3)	Kenai, Alaska to Tokyo	3400		36	16	52R
SOON OPERATIONAL						
(4)	Skikda to Fos					45R
	to Boston - Spot					104R
(5)	Brunei to Tokyo - Old					49R
	- New					90R
CONTRACTED						
(6)	Arzew to Cove Point	3400		31.5	33.5	65R
	to Savannah	3750		31.5	37.5	69R
(7)	Iran to Japan	6600		*25	50	75
UNDER DISCUSSION						
(8)	Nigeria - U.S. East Coast	5000		*38	40	78
(9)	Trinidad - U.S. Gulf Coast	2500	--	25	22	**47
(10)	Venezuela - U.S. East Coast	2400	--	25	21	**46
(11)	Ecuador - Los Angeles	3220		*43	27	70
(12)	North Sea - U.S. East Coast	3850		*50	32	82
(13)	Siberia(Ob) - U.S. East Coast	5300		*50	42	92
(14)	Alaska - Los Angeles	2200		*48	24	72
(15)	Palm Valley to Los Angeles	6600	25	22	50	97
(16)	Palm Valley to Japan	2800	25	22	24	71
(17)	N. Australia (offshore) to L.A.	6800	25	22	52	99
(18)	Yakutsk - Los Angeles	4500	35	23	36	94
(19)	Sarawak - Japan	2300	--	--	--	--
(20)	Persian Gulf to Los Angeles	11600		*25	90	115
(21)	Persian Gulf to U.S. East Coast	11600		*25	90	115

R - Reported or published
* Assumed Cost FOB LNG Plant
** Does not include cost of gas into LNG plant

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